BURLAP AND MULTIWALL PAPER BAGS

FOR HANDLING AND STORING PEA BEANS

U.S. DEPARTMENT OF AGRICULTURE • AGRICULTURAL MARKETING SERVICE • MARKET QUALITY RESEARCH DIVISION

PREFACE

The tests described in this report were made by Agricultural Marketing Service researchers, with the cooperation of the Agricultural Stabilization and Conservation Service and the bean and packing industries.

The Paper Shipping Sack Manufacturers Association, Inc. furnished the multiwall paper bags. The Michigan Bean Shippers Association and the Agricultural Stabilization and Conservation Service cooperated with the Agricultural Marketing Service in furnishing beans and facilities for this study.

Brand names are used for identification of the equipment used in the tests, and their use does not constitute endorsement of this equipment by the Department of Agriculture or imply discrimination of other products or equipment.

CONTENTS

Washington, D. C. April 1964

BURLAP AND MULTIWALL PAPER BAGS FOR HANDLING AND STORING PEA BEANS

by Robert M. Johnson, research chemist, and Judson Thompson[1/], marketing specialist, Field Crops and Animal Products Branch, Market Quality Research Division, Agricultural Marketing Service

SUMMARY

The relative effectiveness of burlap and two types of multiwall paper--smooth and ribbed--bags was compared for handling, shipping, and storing edible dry beans. The beans were stored in 100-pound bags for 6 months in Michigan and for 4 more months in southern warehouses. The quality of the beans was sampled regularly, and after 10 months' storage they were used for school lunches. At that time, there were no significant changes in color, fat acidity, or moisture content of the beans in any of the bags.

School lunch program officials preferred beans from the paper bags because they were free of the dust, dirt, lint and thread often found in beans in burlap bags. The officials said that the ribbed paper bags were easier to handle than the smooth paper bags, and that 50-pound bags would be simpler to handle than the 100-pound bags.

INTRODUCTION

A study was made to compare the relative effectiveness of burlap bags and two types of multiwall paper bags for handling and storage of 100 pounds of dry edible beans at country points and terminals.

The purpose of this study was to compare the quality of pea beans in multiwall paper shipping bags and burlap bags. Cost comparisons were not studied. Burlap bags are generally being used to ship and store dry beans. The study was designed to answer the following questions:

1. How do Type C (smooth) multiwall paper bags compare with Type D (ribbed) multiwall paper and burlap bags with regard to rough handling and stacking during shipment?

2. Can multiwall paper bags be sampled in the normal manner with a probe?

3. What is the relative merit of multiwall paper bags and burlap bags as barriers for moisture, color maintenance, and for other quality factors of beans?

4. Do multiwall paper and burlap bags maintain sanitary conditions?

1/ Mr. Thompson has since retired.

EXPERIMENTAL MATERIALS AND METHODS

Multiwall paper shipping bags were made from four plies of extensible kraft paper[2]. Closures were machine-sewed. The characteristics of the three types of bags are described in table 1.

Table 1.--Types of containers used for transporting and storing dry edible pea beans

Type of bag	Size	Bag construction: No. of plies/basis wt.[1]	Description
	Inches	Pounds	
Type C	21 x 37½	4/50	4 layers of extensible[2] (not ribbed) shipping sack paper
Type D	21 x 37½	2/50, 2/60[3]	4 layers of extensible ribbed shipping sack paper
Burlap	36 x 40	10.4 oz. special[4]	Standard, railroad, new bean bag

1/ Basis weight is the weight per ream of 500 sheets of 24-by-36 inch paper.

2/ Extensible kraft paper absorbs more energy and thus resists breakage.

3/ The two inner plies are 50 weight and the two outer plies are 60 weight.

4/ Weft and warp break strength = 105.0.

Two separate storage studies were made. One lot of pea beans was stored for about 6 months in northern warehouses; the second lot was stored in southern warehouses for about 4 months. All pea beans used in this study were graded U. S. Choice Handpicked according to the United States Standards for Beans[3].

In the first study, five carloads of beans (1,000 multiwall paper and 3,000 100-pound burlap bags) were stored for about 6 months at Bay City and Owendale, Mich. before shipment. Fat acidity and moisture tests were made monthly on representative samples drawn from these bags. Samples were drawn from about 20 percent of the bags selected at random. Special effort was made to sample in the same area of each bag at successive samplings.

Some of the bagged beans were stored in southern warehouses for the second study. A lot of 150 bags (50 of each of the 3 bag types) was shipped by rail in December to commercial warehouses at each location: Richmond, Va.; Logan, West Va.; and Houston, Tex. In addition, one lot of 150 bags was retained at Bay City, Mich. The bags were carefully checked while being

2/ Extensible kraft paper resists breakage; [U. S.] Natl. Bur. Standards Federal Specification (UU-S-48C Amendment 1).

3/ U. S., Agricultural Marketing Service, Grain Division United States Standards for Beans. 11 pp. Sept. 1959.

loaded into the boxcar, to determine how well the paper and burlap bags had held up during the 6 months of summer and fall storage in Michigan.

Preparation of the three railroad cars before loading helped prevent in-transit damage to the bagged beans. The walls of each car were examined for protruding nails and other projections by drawing a board along the walls. Walls and floor were covered with car liner paper. Retaining strips covered the doors. These strips kept the bags away from the doors and prevented damage that might have been caused by shifting of the bags into the doorway.

At each destination the bags were removed from the boxcar and stacked one upon another on three pallets. Each slatted pallet held 50 bags about 4 inches above the floor and about 2 ft. from the wall and from other pallets. The bags were stacked flat on the pallets and even with the edges, with the end sacks interlocked. There was no apparent condensation of moisture on the surface of the bags or on the beans during the warming up period to warehouse temperature.

Representative samples of beans were drawn by probing every 2 months for analysis for moisture content, fat acidity and color, and checked for musty odors and mold growth.

A special pressure-sensitive tape (3M Co.) was used to seal the paper bags which had been torn during probing. In resealing paper bags during cold weather, the area to be taped was wiped free of dust and then warmed by the sampler's hand before applying the tape.

Laboratory Procedures

Moisture content was determined on 250 grams with a Motomco moisture meter. Fat acidity values were determined on 100-gram samples according to the method of Baker and others4/. Color of 75-gram samples was checked with an Agtron reflectance meter.

RESULTS

No significant changes in fat acidity and moisture content of the beans were found in any lot during the initial 6-month storage at Bay City, Mich. In addition, every bag was inspected before loading and found to be in good condition, probably because these beans had been stored on pallets with good air circulation during this 6-month period.

During the 4-month storage in the three southern commercial warehouses, the rate of moisture change in paper bags was about the same as that in burlap. No significant differences in fat acidity were found; however, slight differences were noted in color readings for beans in both types of bags because the beans darkened with time. No musty odor or mold growth

4/ Baker, Doris, Neustadt, M. H., and Zeleny, Lawrence. Application of the Fat Acidity Test as an Index of Grain Deterioration. Cereal Chemistry 34(4): 226-233. 1947.

was detected on any of the samples. Tables 2 to 5 show the results of the analyses of beans in storage for 4 months at different locations after initial storage for 6 months in Michigan.

Table 2.--Quality changes at outer and inner bag positions in dry edible beans stored in burlap and multiwall paper bags at Houston, Tex.

Type of bag and months in storage	Fat acidity values		Moisture content		Color measurement 1/	
	Outer position	Inner position	Outer position	Inner position	Outer position	Inner position
	Index	Index	Percent	Percent	Index	Index
Burlap:						
0	16	16	14.7	14.7	72	72
2	13	15	12.1	12.8	74	82
4	15	17	12.8	12.8	77	84
Paper Type C:						
0	13	13	14.0	14.2	72	71
2	12	14	12.4	12.7	71	70
4	13	14	12.3	12.5	70	72
Paper Type D:						
0	16	18	14.4	15.3	82	76
2	13	16	12.2	13.0	81	75
4	14	16	12.4	12.8	81	74

1/ Meter range was 0-100.

Table 3.--Quality changes in dry edible beans stored in burlap and multiwall paper bags at Richmond, Va.

Type of bag and months in storage	Fat acidity values		Moisture content		Color measurement 1/	
	Outer position	Inner position	Outer position	Inner position	Outer position	Inner position
	Index	Index	Percent	Percent	Index	Index
Burlap:						
0	18	18	15.3	15.3	66	70
2	17	14	13.8	13.3	73	70
4	12	14	11.6	12.8	70	73
Paper Type C:						
0	13	12	14.5	15.0	63	70
2	14	14	13.9	13.2	63	68
4	10	12	11.8	12.8	68	70
Paper Type D:						
0	17	15	15.5	15.4	70	72
2	13	16	14.1	14.7	67	70
4	12	13	11.7	12.7	73	73

1/ Meter range was 0-100.

Table 4.--Quality changes in dry edible beans stored in burlap and multiwall paper bags at Logan, W. Va.

Type of bag and months in storage	Fat acidity values		Moisture content		Color measurement 1/	
	Outer position	Inner position	Outer position	Inner position	Outer position	Inner position
	Index	Index	Percent	Percent	Index	Index
Burlap:						
0	15	17	14.2	15.2	75	77
2	15	16	12.6	11.6	83	86
4	20	19	11.8	12.0	83	82
Paper Type C:						
0	16	16	14.5	15.9	75	80
2	17	16	13.4	12.6	80	79
4	17	19	12.6	12.0	81	80
Paper Type D:						
0	16	16	15.3	15.0	81	78
2	16	16	12.7	12.5	84	80
4	15	17	11.5	12.5	84	78

1/ Meter range was 0-100.

Table 5.--Quality changes in dry edible beans stored in burlap and multiwall paper bags at Bay City, Mich.

Type of bag and months in storage	Fat acidity values		Moisture content		Color measurement 1/	
	Outer position	Inner position	Outer position	Inner position	Outer position	Inner position
	Index	Index	Percent	Percent	Index	Index
Burlap:						
0	17	18	16.4	16.5	77	78
2	18	19	14.3	14.7	78	81
4	19	16	15.2	14.6	84	86
Paper Type C:						
0	18	20	14.0	14.4	76	81
2	19	20	15.0	15.4	76	78
4	19	16	14.5	14.8	81	82
Paper Type D:						
0	18	19	14.6	14.2	78	79
2	18	20	14.8	15.3	76	78
4	18	18	14.6	15.4	87	84

1/ Meter range was 0-100.

The shipment of 800 bags designated for Houston, Tex. was inspected at the point of production (Owendale, Mich.); 650 bags were unloaded at Memphis, Tenn.; and the rest (150 bags) was sent on to Houston. Bags in the partial shipment from Memphis to Houston were damaged when the doors were opened at Houston. Retaining strips were not used in this partial shipment and damage to all types of bags resulted. Shipments such as this, involving less than full carloads (800 bags of beans), should be adequately bulkheaded at one end of the car to assure minimum movement of the bags.

DISCUSSION

The moisture data indicate that stored bagged beans exposed to the atmospheric conditions normally found in Michigan contain about 14 to 15 percent moisture during the first six months (summer and fall) and about 11 to 13 percent moisture when stored in southern commercial warehouses during the next four winter and spring months.

Observations of the authors and comments of employees of the school lunch program who used the beans, showed that beans stored in paper are free from the dust, dirt, lint and thread often found in beans in burlap bags. School lunch program officials at Richmond, Va.; Logan, W. Va.; and Houston, Tex. recommend using smaller 50-pound bags because the 100-pound bag is awkward to handle.

CONCLUSIONS

No significant changes in color, fat acidity, and moisture content were found in beans stored in paper and burlap bags during the initial 6-month storage period at Bay City, Mich., and during the additional 4-month storage period in three southern commercial warehouses.

Multiwall paper bags seemed to bridge areas better than burlap and hence to stack more evenly (figure 1). However, Type C multiwall paper bags were smooth (not ribbed) and were more difficult to handle and stack than the ribbed Type D multiwall paper bag.

The use of the special pressure-sensitive tape was quite effective in resealing punctures caused in probing the multiwall paper bags, especially if the area that was taped was dry and free of dust. In no instance, during the storage periods, was there any evidence of failure of the tape to adhere to the paper bags.

BN-21392

Figure 1.--Multiwall paper bags at left and center; burlap bags at right.

U. S. DEPARTMENT OF AGRICULTURE
Agricultural Marketing Service
Washington, D. C. 20250

- - -

Official Business

Postage and Fees Paid
U. S. Department of Agriculture